



MMRC

ADDING NEW DIMENSIONS

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METRO CUBE

A MUMBAI METRO RAIL CORPORATION NEWSLETTER



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MD Speaks

Ms. Ashwini Bhide, IAS

This Diwali 2018 also marks 25th issue of METRO CUBE and 4 years of MMRC turning in to the JV-SPV of GoI and GoM (50:50). The two years journey of information reach out through METRO CUBE to various stakeholders of the Metro-3 and citizens of Mumbai has been exciting and satisfying. The outreach attempt of information sharing, showcasing of project development started through METRO CUBE in 2016 has been well appreciated; especially by the citizens of Mumbai who are able to connect with the project through our website and social media platforms. This engagement with stakeholders will continue with increased efforts to make content more inclusive and interesting by involving contributions from different groups of people within the project team, various subject experts and citizens.

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Tunnel Segment Casting

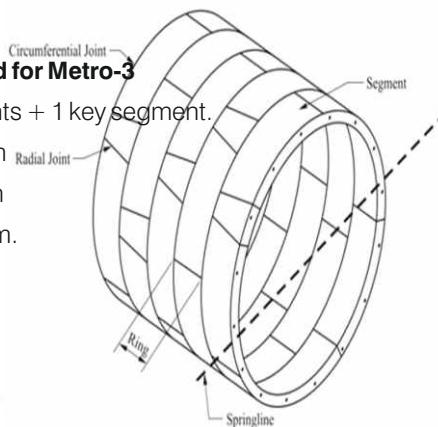
The Reinforced Concrete Segments are cast in the segment moulds which are specifically designed for the casting of segment rings of Metro-3 tunnel. These segments will be installed for lining of underground bored tunnel by Tunnel Boring Machine (TBM). The TBM not only bores the tunnel but also installs precast segment lining of tunnel. There precast segments combine to form rings of permanent lining of the tunnel. The average daily requirement of segments at construction stage is 18 rings (108 segments) against production capacity of 14 – 16 rings (84 segments). Sufficient reverse stock of segments is maintained at the stacking yards. Stacking yards are located within the casting yards and have maximum stacking capacity of 1200 Rings.

Purpose of Lining

Tunnel lining system are installed after excavation to provide permanent support which is both durable and maintainable for design life of the tunnel. The choice of a type of lining system depends primarily on the stand up time of the ground. If the ground is very soft and wet, support needs to be provided immediately behind the excavation face. If ground has a sufficiently long stand up time with or without the use of stabilization; other types of lining becomes feasible. Segmental lining is usually associated with soft ground tunnels and tunnel boring machines. It is made in segment which when put together forms a ring. The segments are erected within the protection of a TBM's cylindrical tail shield to provide a one pass system, providing both stabilization of the tunnel excavation during construction and a permanent service lining.

Specifications of the tunnel ring adopted for Metro-3

- No. of segments in one ring- 5 segments + 1 key segment.
- External Diameter of tunnel ring- 6.35m
- Internal Diameter of tunnel ring- 5.80 m
- Thickness of tunnel segments- 275 mm.
- Width of each segment- 1.4 m.
- Grade of Concrete- M45.
- Concrete Volume / Ring - 7.348 m³



Advantages of precast lining

- Provides complete stable ground support that is ready for follow-on work.
- Segments are easily transported and handled inside the tunnel.
- No additional work such as forming and curing is required prior to use in the tunnel.
- Provides a regular sound foundation for tunnel finishes.
- Provides a durable low maintenance structure.



The segments are fed to the segment erector of the TBM for erecting the segment at its position. The segments are erected one-by-one and completed with placing the key segment in the end.

Segment Casting Procedure:



1. Preparation of Reinforcement Cage

Reinforcement cage are made from Fe500D steel bars as per the approved design. Steel reinforcements are cut and bend as per the design requirement with help of cutting and bending machine. Reinforcement bars with the concrete cover blocks are firmly tied together using tack weld or binding wire 1.25 mm dia.



2. Mould Operation

- i) Prior to the start of segment casting, all parts of the mould need to be cleaned up using grinder with steel brush.
- ii) Close side forms in place and fix them to bottom form and side forms.
- iii) Apply releasing agent of approved form to all surface which shall be in contact with concrete.



3. Concrete pouring and vibrating

Concrete as per design mix is poured in the segment mould. The moulds have pneumatic vibrators installed for the compaction of concrete which are activated with the pouring of concrete in the mould by using concrete bucket.

MD Speaks

Continued from Page 1



Ms. Ashwini Bhide was invited as a speaker at the 20th Sheth Shantaram Mangesh Kulkarni Memorial Lecture organised by 102 year old and reputed NKG Bank.

The project achievements since the beginning of implementation include completion of first tunnelling section of 1.26 km (Pali Ground in Marol to CSIA T2) that has seen daylight in the auspicious presence the Hon. Chief Minister, more than 99% land acquisition and completion of 100% rehabilitation of project affected slum dwellers. Various awareness programs for education and empowering the PAPs, construction workers, especially in the fields of health and safety issues are a few to be mentioned. Apart from these are the significant progress of civil works and award of several systems packages including Rolling Stock (the Metro Rail Cars). Achieving this momentum in this challenging project would not be possible without Govt. of India and JICA facilitation in various clearances, the continued guidance and cooperation from State Govt. especially the CM's war room, various departments of GoM, MCGM, Traffic Police, innumerable stakeholders and especially citizens of Mumbai. The patience and understanding demonstrated by Mumbaikars during monsoon, festival times, with their increasing support is incredible and has undoubtedly

helped us accelerating project activities in odd situations. We urge that this will continue till the completion of the project.

As for the project implementation accomplishments; month of October 2018, has seen in all 16 out of 17 TBMs in operation, to meet the planned targets of completing the tunnelling works. This includes the redeployment of the Wainganga 1 of Package 7 (after completing first tunneling section) in other section. This month some important legal hurdles have also been cleared noteworthy of them include NGT directive to Vanashakti to withdraw their application to declare Aarey Colony as forest. This has cleared the long-standing hurdle in construction of the depot works. This month has also seen award of 3 systems contracts; Signalling and Telecommunications including Platform screen Doors, 2 contracts under vertical transportation of metro commuters i.e. Lifts and Escalators.

Coming months the project works are expected to accelerate and citizens are requested to continue their cooperation for us to keep pace of the project that is expected to change the way Mumbai would travel in the 21st century.



4. Steam Curing

The curing of freshly poured concrete segments is done by steam curing for 6 hours. The Steam provides 100% relative humidity with temperature range of 55-65 degrees Celsius which results in rapid curing and prevention of the loss of water from concrete and generation of cracks in concrete segments.



5. Demoulding

After the casted segments attain strength of 25% of design strength or 12.5 MPa whichever is greater, the segments are lifted from the moulds with the help of vacuum lifters and are sent to touch up area where repair works (if any) are done. Later, curing compound is applied and marking is done on the segments.



6. Stacking of segments

The segments are then shifted to the stacking area from where they are dispatched to the respective tunnelling location.

Aarey is not a FOREST

The present transport modes available in the city of Mumbai like suburban trains, buses and other public transport are overloaded, exceeding their capacity leading to overcrowding, stressful and unsafe travel. Density of travellers is double the desired capacity of trains. The daily commuting of people to reach their places of employment/activities has become stressful due to traffic congestion, increase in pollution level, which impacts the health of people. In order to overcome these challenges associated with public transport and to provide a safe, comfortable and affordable public transport system, Metro Master Plan was conceived in the year 2003. Metro-3 is a part of Metro Master Plan, connecting the unconnected areas of South and North Mumbai.

Location of Metro-3 car depot was finalised at Aarey colony in 2011 at the stage of DPR. This location was identified on the basis of detailed survey of alternate possible locations at Mahalaxmi race course, exhibition ground at BKC, Kalina University Campus and Aarey Colony. In 2015, technical committee constituted by State Government studied several alternative sites for car depot and pros and cons of each alternative and recommendation of the technical committee was ascertained. Further, taking into consideration the likely delay in taking over the land of the alternate site due to litigations, it was jointly decided by the State Government, MMRDA and MMRC to have Metro-3 depot at Aarey.

Aarey milk colony area consists of Central Government Institutes (Central Poultry Farm, Modern Bakery, NDDB, RBI), State Government Institutes (Mumbai Veterinary College, SRP, MHADA, MCGB, Film City, Fishery), Private Offices, godowns, Film Studios, Roads, Buildings, Waste Lands, Farm Roads apart from area under Lawns, Gardens, Grass/green fodder patches etc. The land at Aarey milk colony area has been used for non-forest purposes for decades. Within the Aarey milk colony area, there are school buildings, police wireless station, hospitals, godowns, salt breaking unit, factories, general stores, reliance energy substation and a ready-mix concrete plant. The Konkan Krishi Vidyapeeth, boiler house, central dairy buildings, garages, Mahananda Dairy factory & their staff quarters are also located in the Aarey milk colony area. Only about 1/6th of the land area which is 17% of the total area is covered by trees. The tree cover is scattered, and the majority of the area is grass lands/grazing lands used by cattle in the Aarey Milk Scheme area.



Work Shop at Depot



Stabling Shed at Depot



Auxiliary Sub-station Building

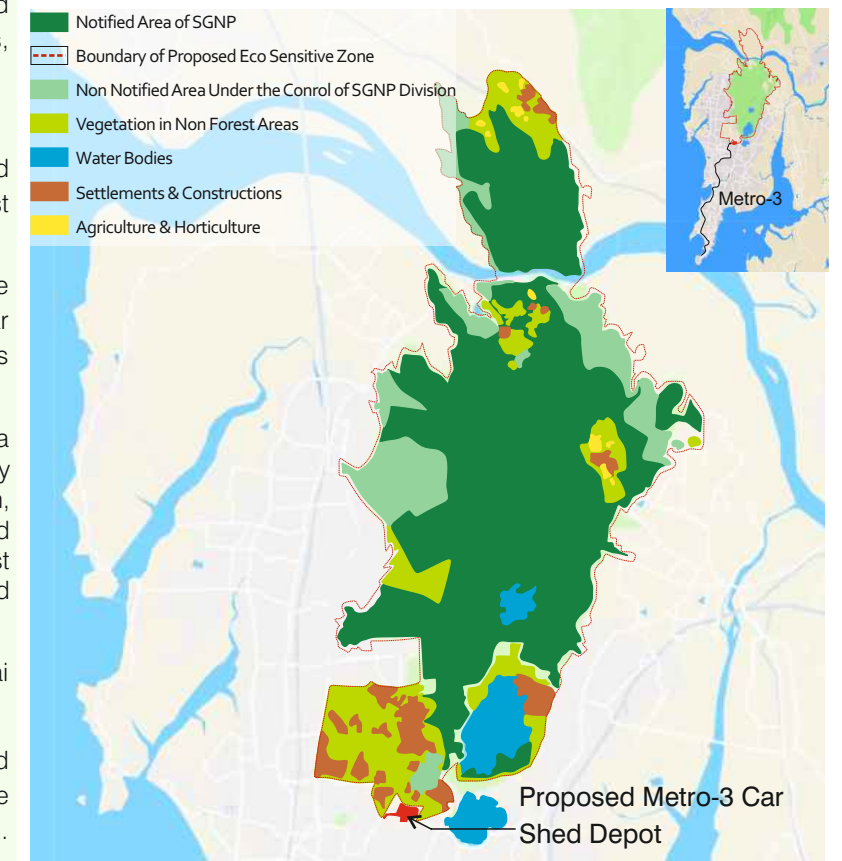
- December 2011** The alignment and car shed depot at Aarey Colony area were notified calling suggestions/objections on Social & Environmental Impact Assessment reports through newspaper advertisement and the finalised plans were displayed at various government offices.
- April 2012** Public consultations for citizens and stakeholders were held.
- September 2013** Government of India notified the alignment along with depot at Aarey Colony.
- March 2014** State Government approved the construction of Metro-3 and specifically mentioned of handing over 30 ha land of Aarey milk colony for Metro-3 car depot.
- December 2014** Vanashakti started a petition to save Aarey.
- October 2015** State accepted a six-member committee report to shift Metro-3 car shed to Kanjurmarg, relieving trees from being hacked.
- November 2015** The recommendation of the technical committee was ascertained and State Government, MMRDA and MMRC, taking into consideration the delay in taking over the land of the alternate site due to litigations, decided the site of depot at Aarey colony as a suitable location.
- December 2015** State handed over the 30 ha to MMRC for Metro-3 car shed depot.
- February 2016** State Government (Forest Department) in their affidavit submitted to NGT mentioned that 1280 ha land of Aarey Colony has not been recognized and notified and/or identified and demarcated as a "Forest Land" in any record.
- December 2016** MoEFCC, Gol notified that Aarey colony is not a forest area and also outside the Eco Sensitive Zone (ESZ) of Sanjay Gandhi National Park (SGNP). State Government approved the modified layout of car shed depot at Aarey colony. The depot has been redesigned to exclude the 5 ha area, most of which is covered by the tree, leaving 25 ha area for development of the depot.
- October 2017** Govt. Notification dated 24th August 2017 and 9th November 2017 was challenged by Amrita Bhattacharjee in Writ petition filed by her before Bombay High Court. She claimed Aarey is a naturally forested area and impugned notification would result in destruction of green cover. Through her petition, she asked court to direct the State Govt. to allot land at Kanjurmarg for construction of metro car shed depot. Vide order dated 26th October 2018, Court rejected petitioner's argument that the land is a forest and the notifications permit use of forest land for metro car depot while dismissing the Writ Petition filed by Amrita Bhattacharjee.
- December 2017** Government of Maharashtra sanctioned the part revised development plan, 2034 of Greater Mumbai with depot site at Aarey Colony as reserved for Metro/Mono car shed (RT3.1).
- April 2018** MCGM have approved the remodelling of the existing storm water drainage system at the Metro-3 shed car depot area at Aarey colony, which would be implemented to channelize the storm water from the catchment area of Aarey colony. This will ensure that the flooding does not take place in the downstream.
- June 2018** NGT restrained MMRC from dumping of debris, reclamation and cutting of trees at Aarey during pendency of the application. MMRC moves an urgent application before NGT Delhi, asking it to withdraw the stay order, but NGT rejected the application
- August 2018** MMRC filed appeal for relief against the restraining order by NGT. Court transferred the matter to Delhi Principal Bench with direction to expediate the disposal of application.
- September 2018** Vanashakti withdraws original application filed before NGT. Stay order and application dismissed by NGT.
- October 2018** After withdrawing NGT application, Vanashakti filed another petition no. WP 3417 of 2018 before Bombay High Court to declare entire 1280 ha of Aarey as 'Reserved forest', 'Protected Area'. Vanashakti sought order from court to restrain Govt. from granting permission for non-forest activity in Aarey and stop all ongoing construction activities in Aarey. Justice Oka and Justice Sonak directed this matter to Bench of Justice Dharmadhikari who has heard arguments on same subject matter in WP 2766 of 2017 filed by Amrita Bhattacharjee.

Vanashakti played with the people's sentiment

Vanashakti was misinterpreting the previous orders since the Aarey had been notified as a non-forest area and outside the Eco Sensitive Zone (ESZ) of Sanjay Gandhi National Park (SGNP).

Ms. Amrita Bhattacharjee Mislead the High Court

Amrita Bhattacharjee challenged the earlier orders and asked the High Court to allot the Kanjurmarg area for the Metro-3 depot instead of Aarey Colony. Court found that Aarey land designated for the depot is not under forest zone. Hence the request of alternative land at Kanjurmarg was rejected and a permission was issued to MMRC to proceed with construction of the depot at Aarey.



Depot has been redesigned to exclude the 5ha area which comprises of 1026 number of trees, thereby effective area of depot is proposed to be 25 ha which is only 0.25% of SGNP and 2.33% of Aarey Colony. Loss of trees will be compensated adequately by planting new trees. 8 ha land is available for tree plantation in Aarey colony area in front of depot. Area required to plant one tree is approximately 16 m². Thus 5000 trees can be planted in the available 8 ha of land. Upon completion, the areas between the facilities will be replanted with ground cover and shrubs as a landscape development. Metro-3 car shed depot consists of a workshop shed, an infrastructure building and two stabling sheds plus ancillary facilities interconnected by the 16.82 km of depot track lines. The depot is to be constructed on a levelled plain which needs to be elevated above the flood level, which will require the clearance of existing plant growth on the plot.

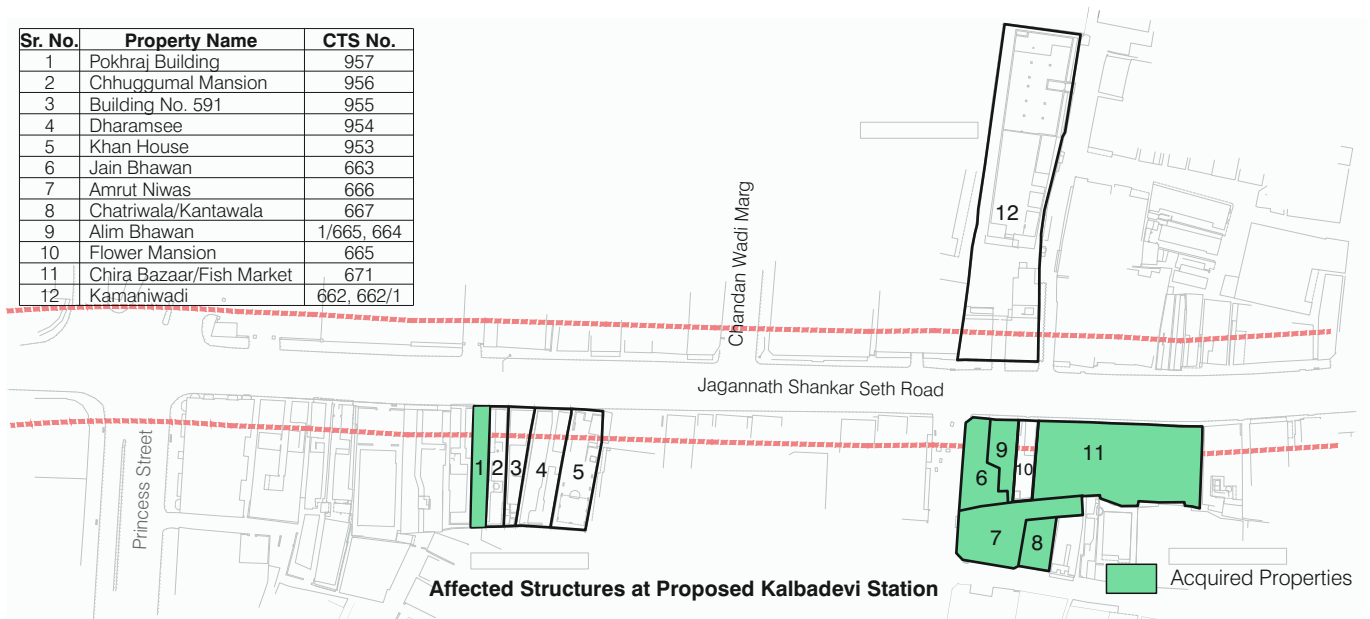
Redevelopment Status Update

Kalbadevi and Girgaon

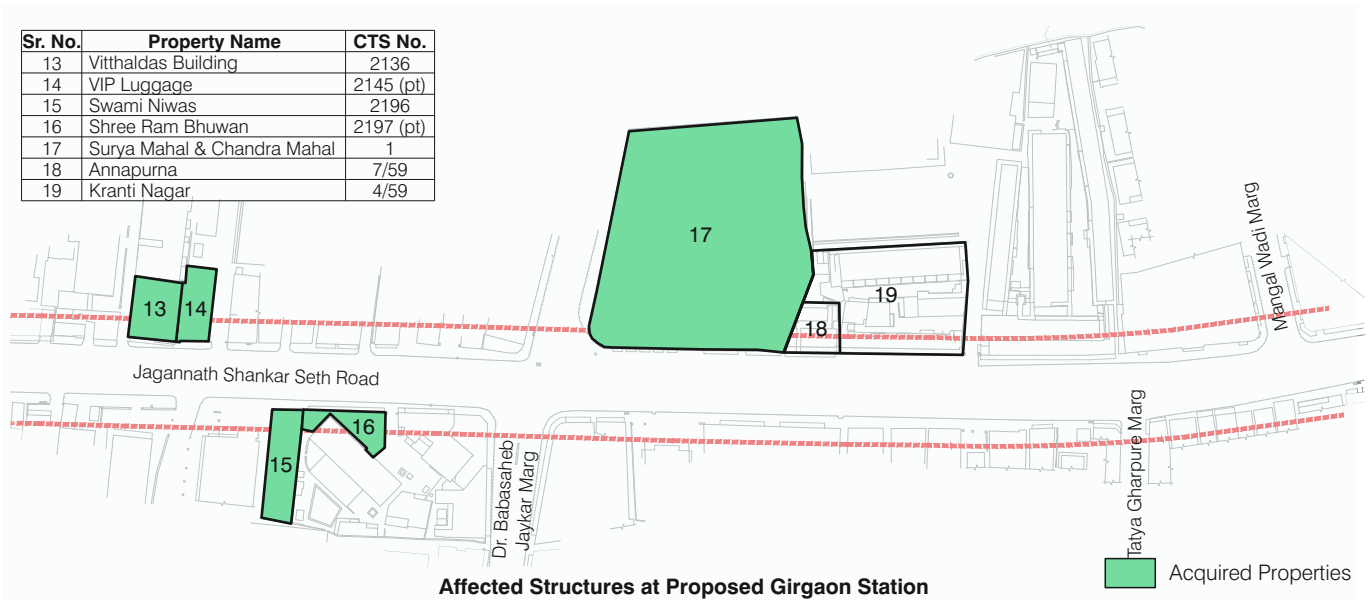
Land Acquisition Update:

Kalbadevi and Girgaon Metro Stations, on Jagannath Shankarshet Road, are being constructed in the most congested and challenging areas of Mumbai surrounded by old residential and commercial buildings. Out of the total 21 affected properties of Kalbadevi and Girgaon, land acquisition for 11 properties is complete which accounts to approx. 60% of total land requirement for these two metro stations. Considering the private ownership of the properties, legal issues, long negotiations with the private owners etc, this is a huge achievement. The remaining portions of land are proposed to be acquired by the end of November 2018.

Sr. No.	Property Name	CTS No.
1	Pokhraj Building	957
2	Chhuggamal Mansion	956
3	Building No. 591	955
4	Dharamsee	954
5	Khan House	953
6	Jain Bhawan	663
7	Amrut Niwas	666
8	Chatriwala/Kantawala	667
9	Alim Bhawan	1/665, 664
10	Flower Mansion	665
11	Chira Bazaar/Fish Market	671
12	Kamaniwadi	662, 662/1



Sr. No.	Property Name	CTS No.
13	Vitthaladas Building	2136
14	VIP Luggage	2145 (pt)
15	Swami Niwas	2196
16	Shree Ram Bhuvan	2197 (pt)
17	Surya Mahal & Chandra Mahal	1
18	Annapurna	7/59
19	Kranti Nagar	4/59



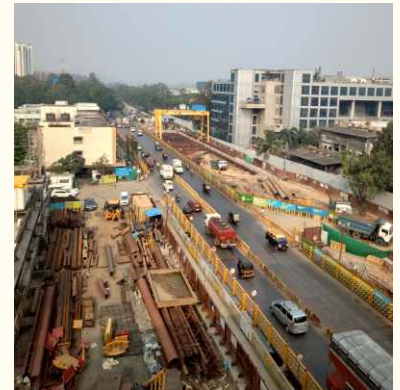
R&R Update:

Out of the total 778 PAPs, 429 provisional agreements have been executed with MMRC towards temporary accommodation. MHADA NOC is mandatory for redevelopment of cess properties. Due to the constant efforts taken by MHADA executives and officials, MHADA survey for all the 17 cess properties is complete. Tenant eligibility and area disclosure lists for 15 cess properties have been released by MHADA which has resulted in substantial increase of PAPs executing Provisional Agreements with MMRCL.



Project Progress Update

As on 27th October, 2018



SEEPZ Station work is in progress

Legend
█ Planned
█ Completed

Metro-3 project covering 33.5 km (Fully Underground) at a total cost of 23,136 crore was sanctioned in 18 July 2013. The project is divided into 18 main packages of civil works and system components.

Government of Maharashtra gave advance possession of the land to MMRC. Private land acquisition would be completed shortly. Rehabilitation and Resettlement of Project Affected Persons (PAPs) are almost completed. Shifting of PAPs on government land/other priority sites is in progress and will be completed in due course.

7 main packages of civil works with 26 underground stations and tunneling were awarded in July 2016. Depot civil works contract including Depot Station (at grade) awarded in September 2017. All 17 Tunnel Boring Machines received and 16 started working with 10.95 km tunneling work completed. Out of 26, 25 underground station work is in progress, 36% excavation and 84% Secant Piling work are completed, Base Slab construction at various stations is in progress. Earthwork, Storm Water drain and Boundary wall constructions are in progress at Depot.

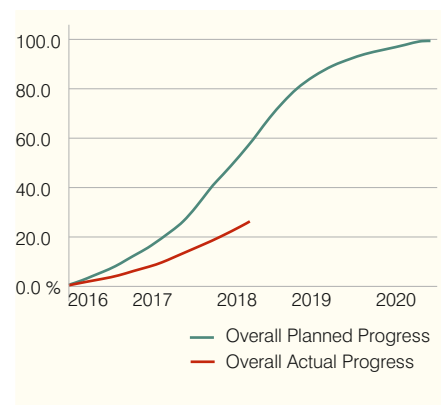


Marol Naka Station Work is in Progress

Systems contracts has been awarded for 7 packages i.e. Traction (25 kV Overhead Contract) System, Power Supply System, Rolling Stock (for 31, 8 car Trains), Depot (E & M) works, Escalators (Lot-E2, Siddhi Vinayak to Cuff parade 14 Stations), Lifts (Lot- L2, Siddhi Vinayak to Cuffe Parade, 14 Stations), Signalling and Train Control, PSD and Telecom Systems.

Total physical and financial progress of Metro-3 project is 28% and 31.7% respectively.

Schedule dates of completion are 30th June 2021 for phase 1 (BKC to Seepz) and 31st December 2021 for phase 2 (Colaba- Bandra-Seepz Corridor). Sovereign loan of Rs. 13,235 crore has been tied up with JICA.



Project Cumulative Progress - October 2018

RAMS Engineering Services

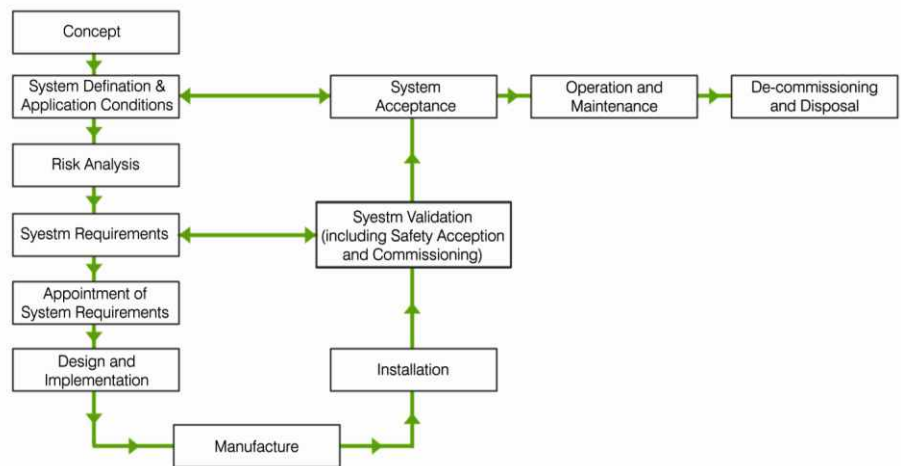
Reliability , Availability , Maintainability & Safety

Infrastructure projects such as metro-rail are capital intensive projects. Their monitoring and control are required throughout all the phases to achieve the characteristics such as Reliability, Availability, Maintainability and Safety. Dependability and Safety is elementary requirement for efficient urban transport since they directly impact the quality of customer service.

The RAMS Engineering has evolved in Defence and Civil Aviation since 1930. Various tools, processes softwares, methods and standards have been developed to achieve Reliability and Safety. European Commission has issued EN 50126-1999, Railway applications-Specification and demonstration of Reliability, Availability, Maintainability and Safety. This is considered as the best international practice in the field of RAMS Engineering. This standard has five parts and describes the factors influencing Railway RAMS, how to manage these factors to achieve RAMS targets and how to demonstrate achieving the same.

It adopts lifecycle model for the RAMS process, wherein the RAMS process is carried out in each phase i.e. Concept Development, Design, Manufacturing, Commissioning, Operation and Maintenance. These standards are aligned to ISO 9000 TQM, so compliance of ISO 9000 series is mandatory in manufacturing phase while complying EN 50126 process.

The updated version of these total dependability standards have been issued in 2017, after 18 years of experience of provisions of EN 50126 -1999. 2017 version is more coherent and consistent. Many new aspects have been added in the process to make it more robust. PM/GC is fully responsible for RAMS activities on the project.



PM is required to verify at each stage such as design, manufacturing, installation etc. that the standards and procedures are fully compliant to EN 50126-2017. It has enhanced the accountability of GC in achieving reliability, availability, maintainability and safety targets. Knowledge-sharing sessions are being conducted regularly to sensitise the GC team for being proactive in total quality control at every stage of project development.

In this background it is heartening to note that MMRC has decided to adopt these best international practices of RAMS Engineering in Metro-3 project. All the bid, RFPs and contract agreements in Metro-3 project have specified the RAMS targets and mandated compliance of EN 50126-2017 for developing metro project by total quality control. In the process, GC has to check, monitor, verify, validate and certify the compliance of EN 50126 standards for achieving performance related key performance indicators. In addition, Independent Safety Assessor will be employed for Safety assessment of rolling stock and signalling, train control, and Platform Screen Door sub-systems.

Thus adequate planning has been done to achieve total dependable metro-system. All the stake holders such as Client, GC team, Contractors are being continuously advised to comply the spirit of RAMS Engineering meticulously.

MMRC Control Room
 Contact us @ +91 9136805065 to report monsoon related grievances pertaining to Metro-3 construction work.



Website Link



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